



City of Detroit

OFFICE OF THE AUDITOR GENERAL

**Audit of the
Detroit Transportation
Corporation's
Maintenance Operations**

November 2004



City of Detroit
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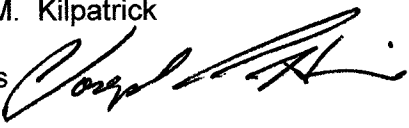
Joseph L. Harris, CPA, CIA
Auditor General

Sharon L. Gipson, CPA
Deputy Auditor General

MEMORANDUM

DATE: May 4, 2005

TO: Honorable City Council
Mayor Kwame M. Kilpatrick

FROM: Joseph L. Harris 
Auditor General

RE: Audit of the Detroit Transportation Corporation's
Maintenance Operations

CC: Ms. Barbara Hansen, Interim General Manager

Attached for your review is our report on the Audit of the Detroit Transportation Corporation's (DTC) Maintenance Operations.

This report contains our audit purpose, scope, objectives, and methodology; our summary of findings and recommendations; background; our findings and recommendations; our other issues; and the agency's response.

We appreciate the cooperation and assistance that we received from the employees of the DTC.

Copies of all of the Office of the Auditor General's reports can be found on our web site at www.ci.detroit.mi.us/legislative/CharterAppointments/AuditorGeneral.

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AUDIT PURPOSE, SCOPE, OBJECTIVE, AND METHODOLOGY

Audit Purpose

The City Council requested the Office of the Auditor General (OAG) to perform an audit of the Detroit Transportation Corporation (DTC) in response to the Detroit People Mover (DPM) elevated rail system shutting down three days prior to opening day of the 2004 North American International Auto Show. The purpose of the audit was to determine whether the DTC is taking the necessary actions towards ensuring that the system will be a reliable source of public transportation.

Audit Scope and Objectives

The OAG conducted an audit of the Detroit Transportation Corporation to determine:

- The status and effectiveness of recruiting, training, and retaining qualified maintenance technicians, supervisors, and engineering support personnel that are essential to properly maintaining a highly sophisticated system.
- The status of plans to overhaul the DPM, to replace or rehabilitate either certain components that are obsolete, or components that have experienced sufficient deterioration to degrade their performance.
- The progress made in implementing a plan to improve equipment preventive maintenance and on-time performance of its preventive maintenance.

Our audit was conducted in accordance with Governmental Auditing Standards issued by the Comptroller General of the United States, except that the OAG has not received an external peer review within the past three years.

Audit Methodology

To accomplish our objectives, our audit included the following:

- Reviews of the KPMG 1999 Operational Audit report, the Federal Transit Administration 2003 Triennial Review, and comprehensive reviews performed by external engineers.
- Reviews of the DTC's budgets for the five fiscal years ended June 30, 2004.
- Interviews with DPM management, technicians, and others.
- Reviews of maintenance technician job descriptions, education, and related work experience.
- Reviews of DTC's maintenance training history, maintenance training plan, and staffing levels of mechanical and electrical technicians.
- Review of preventive maintenance on-time performance.
- Reviews of other relevant documentation and observation of DPM systems and operations.

SUMMARY OF FINDINGS AND RECOMMENDATIONS

Findings	Recommendations
1 The DTC has an excessive number of open work orders for preventive maintenance.	We recommend the DTC: perform comprehensive quality reviews of completed work orders; submit the status of work orders to the maintenance scheduler in accordance with DTC procedures; begin accurately tracking manpower utilization; and provide periodic preventive maintenance reports to the City Council and to the Auditor General.
2 Mechanical and electrical technicians complete training courses at an unacceptable rate.	We recommend the DTC: increase its completion rate of training mechanical and electrical technicians; incorporate more complete formal training to promote and enhance preparedness for on-the-job training.
3 Mechanical and electrical technicians do not have adequate access to tools to perform their tasks efficiently.	We recommend the DTC: ensure all of its technicians are provided a complete set of tools and have ready access to any special tools needed, review tool requisitions for appropriateness, and purchase necessary tools in a timely fashion.
4 Maintenance manuals are outdated, incomplete, or not always readily available.	We recommend the DTC: ensure efficient utilization of its maintenance manuals, drawings and catalogs; develop a standard operating policy for performing periodic inventory and updates of its maintenance manuals, drawings, and catalogs; implement a means of ensuring the return of manuals to a designated location; ensure all technicians are updated as to the sources of maintenance documentation and procedural information available to them; and train all users of maintenance material to be competent in utilizing the computer to acquire needed information.
5 The DTC maintenance department is not performing adequate quality assurance inspections.	We recommend the DTC: develop and implement a comprehensive quality assurance program to improve maintenance operations; adequately train the individuals that are delegated the responsibility for administering the program; begin tracking critical maintenance performance measurements, assessing feedback, and implementing enhancements.
6 The Detroit People Mover system is in immediate need of a mid-life overhaul of its fleet of twelve vehicles.	We recommend the immediate completion of its mid-life overhaul on all vehicles.

BACKGROUND

The Detroit Transportation Corporation (DTC) was established in 1985 by the City of Detroit, pursuant to State Act No. 7 of Public Acts of 1967, as a component unit of the City to oversee the construction and operation of the Central Automated Transit System (People Mover) in downtown Detroit.

The Detroit People Mover (DPM) is a fully automated light rail system that operates on an elevated single-track loop in Detroit's central business district.

Beginning on August 1, 2002, the DTC entered into a three-year agreement with Parsons Brinckerhoff, Inc. (PB) for comprehensive on-going assessments of DPM subsystems. PB is a leading transportation-engineering firm. The company provides planning, design, construction, program management, and consulting services. It specializes in transit systems, tunnels, bridges, highways, and airports.

For the past two years, PB has performed ongoing comprehensive assessments of the various People Mover subsystems, and continues to provide oversight and technical assistance for system upgrades and rehabilitation. Notwithstanding the agreement for engineering consulting services, PB stated in its August 2002 Maintenance Audit Report of the DPM that although consulting engineers can be hired and will probably always be needed in specialized areas, the DTC should consider an in-house engineering resource to provide a basic understanding of and continuity among the multiple technical issues that it faces. Currently, the DTC does not have an engineer on its staff.

DPM Subsystems

The DPM System is comprised of seven (7) major subsystems that play a major role in the overall operation and function of the DPM system. The subsystems and brief descriptions are as follows:

Automatic Train Control (ATC)

The vehicle on-board ATC system is used to provide safe movement of the DPM vehicle along the guideway.

Communications

The DPM communications system is a fiber-optic network that provides the vital communication links between the vehicles, stations and personnel.

Facilities

The DPM maintenance personnel handle all of the maintenance duties inside 13 passenger stations, two (2) substations and the Maintenance/Control facility.

Guideway

The guideway is 2.9 miles in length. The guide is constructed of a reinforced concrete beam structure, which is supported by reinforced concrete columns. The guide has 35 curves, and eight (8) switches.

Power Distribution

The power distribution system provides the source of power to put the DPM in motion. This is known as propulsion power. It is supplied by the Detroit Public Lighting Department to the guideway system via two substations.

Supervisory Control and Data Acquisition (SCADA)

The SCADA system monitors and controls fire alarm, security, propulsion power, drain heaters, faregates, elevators and guideway lighting.

Vehicles

The DPM fleet is comprised of 12 aluminum-bodied vehicles that are powered by linear induction motors. The vehicles are designed to operate as single units or married pairs.

FINDINGS AND RECOMMENDATIONS

1. Excessive Number of Open Preventive Maintenance Work Orders

The DTC has an excessive number of open work orders for preventive maintenance. We reviewed the database of maintenance work orders for the period December 1, 2003 through June 30, 2004, and determined that there were 679 open work orders for that period. The work orders consisted of 384 preventive maintenance assignments, 176 non-scheduled maintenance assignments, 113 corrective maintenance assignments, and 6 other maintenance items. The 679 open work orders had accumulated over a seven-month period since the database was cleared of all old work orders in November 2003.

According to DTC staff, prior to February 2003, the scheduler position had been vacant for approximately five years. As such, maintenance supervisors were delegated some of the scheduler's responsibilities. However, the maintenance database was not being updated in a timely fashion. The assistant operations manager stated that the maintenance staff has had insufficient resources to perform preventive maintenance in accordance with its maintenance plan.

The current maintenance scheduler, whose responsibilities include evaluating compliance with scheduled maintenance and manpower utilization, performed an evaluation of maintenance activities, and submitted a Maintenance Department Evaluation Report to management on July 23, 2003. The report included the following:

- Scheduled Preventive Maintenance work orders are not being performed or completed in a timely manner;
- The Preventive Maintenance Control database contains duplicates of procedures and is not being used to its fullest capacity;
- The database includes data that needs to be deleted;
- DTC's assets that are in the database are not assigned to any supervisor's areas of responsibility; and
- Supervisors have not reported the status of their assigned areas of responsibility for long-term maintenance planning to the maintenance scheduler.

When preventive maintenance is not performed or achieved to a predetermined level of adequacy, the probability of system failure without warning is increased. Moreover, DTC's maintenance personnel will be less prepared to deal with corrective maintenance and nonscheduled maintenance, if it does not perform the required preventive maintenance.

The DTC has an established maintenance plan. Work orders are automatically generated and printed by a computerized system. According to DTC's Maintenance Procedure number 001 (Rev.1), "Once the technician has provided the Maintenance Shift Supervisor, or Lead Hand (MSS/LH) with the work order for review, the MSS/LH will verify that any required information has been provided on the work order. The MSS/LH will forward the work order with all information required to the Scheduling Office as soon as possible. Where an emergency condition exists as a result of the incomplete status of a work order, a record of the work done and work still required will be provided to the Scheduling Office by the MSS/LH, and the work order will be passed on to the incoming MSS/LH for further action."

Recommendation

We recommend that the DTC perform comprehensive quality reviews of completed work orders to ensure that preventive maintenance is completed in its entirety, and in a timely manner.

We also recommend, to facilitate long-term maintenance planning, that the DTC submit the status of work orders to the maintenance scheduler in accordance with DTC standard procedure.

Further, we also recommend, to ensure that technicians are using their time efficiently, that the DTC begin accurately tracking manpower utilization.

Finally, we recommend that the DTC provide periodic preventive maintenance reports to the City Council and to the Auditor General.

2. Low Technical Training Rate for Mechanical and Electrical Technicians

The mechanical and electrical technicians are not completing the required training. DTC's training plan indicates that its technicians should complete a series of training courses within a five-year period from the date of hire. Our analysis disclosed that the average completion rate of training courses for Mechanical Technicians (MT) was 49 percent. That percentage decreased to 43 percent when calculated based on the training rate completed by the newest MTs, who comprise 75 percent of the MT work force. Table 1 reflects the percentage and number of training courses completed by MTs out of a total of twenty courses (excluding safety training).

Table 1: Training Courses Completed by Mechanical Technicians as of June 30, 2004				
Mechanical Technician	Date of Hire	Service Years	Percentage of Courses Completed	Number of Courses Completed
MT I	06/25/2001	3.0	25%	5/20
MT I	05/07/2001	3.2	25%	5/20
MT I	03/02/2000	4.3	40%	8/20
MT I	02/22/1998	6.3	55%	11/20
MT I	10/13/1997	6.7	55%	11/20
MT I	06/02/1997	7.1	55%	11/20
MT I	08/15/1991	13.2	70%	14/20
MT II	08/27/1989	15.2	65%	13/20
AVERAGE		7.4	49%	

We also determined that the average completion rate of training courses of electrical technicians (ET) was 32 percent. That figure decreased to 20 percent when calculated based on the training rate completed by the newest ETs, who comprise 57 percent of the ET work force. Table 2 reflects the percentage and number of training courses completed by ETs out of a total of twenty-nine courses (excluding safety training).

Table 2: Training Courses Completed by Electrical Technicians as of June 30, 2004				
Electrical Technician	Date of Hire	Service Years	Percentage of Courses Completed	Number of Courses Completed
ETI	07/15/2002	1.9	14%	4/29
ETI	05/28/2002	2.1	24%	7/29
ETI	03/18/2002	2.3	17%	5/29
ETI	03/20/2000	4.2	24%	7/29
ETII	11/20/1989	14.4	52%	15/29
ETII	07/27/1987	17.1	41%	12/29
ETII	01/12/1987	17.5	55%	16/29
AVERAGE		8.5	32%	

Both mechanical and electrical technicians should have completed all training courses within five-years of the date of hire.

The DTC's technical training plan indicates different training subjects to be administered over different periods including: annually; bi-annually; tri-annually; every four years; or

every five years at which point every technician should have completed every training subject at least once within a five-year period. The following list consists of the technical training courses to be completed by either electrical and/or mechanical technicians within the five-year period.

- DPM System Overview and System Safety
- Vehicle & Wayside Maintenance Overview
- Vehicle Operations Certification Train Driver
- Vehicle Operations Re-certification Train Driver
- Propulsion System Running Maintenance
- Propulsion System Repair Maintenance
- FIN Training
- Coupler Maintenance
- Truck Maintenance
- Electro/Hydraulic Brake Maintenance
- Track Brake Maintenance
- Heating, Ventilation & Air Conditioning (HVAC)
- Body & Seat Maintenance
- Door System Maintenance
- Health Monitor Panel Maintenance
- Vehicles Electrics & Train-line Interface
- DC/DC Converter & Battery Monitor Maintenance
- Power System Maintenance Course
- Supervisory Control & Data Acquisition (SCADA) Maintenance Course
- SCADA Fiber Optic Network
- Fare Collection Maintenance
- PABX Maintenance
- CCTV Maintenance
- System Operation Rules & Procedure and System Safety Procedure
- De-energization/energization of MCF Propulsion Power
- De-energization/energization of Revenue Guideway Propulsion Power
- AARU Training
- Facility Door Training
- Facility Lighting Training
- Faregate Training
- Guideway Maintenance Training
- Fire Extinguisher PM
- DPSI Training
- VOBC Training – Complete
- Vehicle Radio Communication
- ATC Central/Wayside Maintenance

According to DTC management, all DTC technicians are responsible for servicing all DPM subsystems as opposed to specializing in one or two areas. Therefore, comprehensive training is critical to ensure effective maintenance. The Parsons Brinckerhoff, Inc. (PB) 2002 Maintenance Audit Report indicated that the time DTC allotted for training was so inadequate that the staff needed “an even more intensive training program to be brought up to a level that would normally be needed to maintain a standard level of effectiveness.” The potential effect of this disparity, should the more experienced technicians no longer be employed by the DTC, would be the inability of the less experienced technicians to handle complex maintenance issues. According to PB, DPM technicians are burdened with a heavy workload of pressing work orders that does not allow adequate time for training. The senior staff is so overworked that they cannot take time to train the junior staff in a classroom environment. All of the training is therefore “on-the-job” training, which does not work effectively in this type of system. The DTC budgeted \$118,000 in fiscal 2003-04 for training, but only \$20,268, or 17 percent, was actually spent on training.

According to DTC operations management, it has been difficult to devote time to training when there are limited technicians to perform the work required on a day-to-day basis. There is such a significant disparity between technicians with many years of experience, and broad knowledge of People Mover subsystems that only the more experienced technicians are qualified to handle more comprehensive tasks. DTC’s General Manager stated that “due to the extreme amount of effort required by staff to reconstruct

the DPM guideway at the J.L. Hudsons site, and the ongoing development activities surrounding the system (i.e. the Compuware office complex and parking structure, the Premier parking structure, and the demolition and complete redesign of the DPM guideway and station at the Renaissance Center complex), the time allocated to training was diverted to ensuring the continued functionality of the system and replacement of the DPM guideway.”

Recommendation

We recommend that the DTC complete the training for mechanical and electrical technicians. All technicians with five or more service years should have completed all training courses at least once.

We also recommend that the DTC incorporate more formal training to promote and enhance preparedness for on-the-job training.

3. Inadequate Tools and Equipment

The mechanical and electrical technicians have inadequate access to tools to perform their tasks efficiently. According to several employees, most of the newer technicians did not receive complete tool sets after being hired. In addition, over the past few years the DTC has not replaced broken tools. Requisitions submitted by maintenance supervisors for new technician tool sets, dating as far back as 1997 were never ordered. One of the maintenance supervisors indicated that he does not have an adequate tool supply for his technicians.

The Assistant Operations Manager, who is responsible for ordering the tools requested by technicians, indicated that because operations had become so demanding, particularly due to a lack of personnel, he had not found time to check and approve requisitions for tools.

The lack of tools has forced technicians to fabricate certain tools and borrow tools from other technicians. As a result, technicians spend valuable time gathering the tools needed to perform their tasks. The DTC does not track manpower utilization. Therefore, the downtime experienced as a result of technicians lacking the proper tools to perform their tasks cannot be quantified.

DTC Maintenance Procedure Number 011 indicates that:

Availability of required hand tools is fundamental to the successful operation of the Detroit People Mover (DPM). Adherence to procedures regulating the purchase, inventory, issuance, security, maintenance and replacement is crucial. To ensure the DPM maintenance tooling is responsibly maintained, the maintenance shift supervisor shall perform an inspection inventory once every ninety days. Technician tool sets will be issued to the maintenance technician commensurate with employment. The DPM Maintenance Division shall maintain an inventory of hand tools, which will enable the maintenance technicians and utility workers to perform preventive, corrective and custodial maintenance on each and every facet of the system as so designated.

Recommendation

We recommend that the DTC ensure that all of its technicians are provided a complete set of tools, and have ready access to any special tools needed to perform tasks more efficiently and effectively.

We also recommend that the DTC provide newly hired technicians with, or ready access to, the tools and equipment needed, in accordance with DTC policy.

Finally, we recommend that the DTC review tool requisitions for appropriateness, and purchase necessary tools in a timely fashion.

4. Poor Utilization of Maintenance Manuals and Related Software

Maintenance manuals are outdated, incomplete, and not always readily available. Technicians stated that although there is access to repair manuals, they are not updated for new procedures on new parts. Over the years, new parts and upgrades have been installed that require revisions to maintenance and repair procedures. The Parsons Brinckerhoff, Inc. (PB) August 2002 Maintenance Audit Report regarding maintenance procedures for vehicles indicated that, "Maintenance manuals and parts catalogs were provided with delivery of the vehicles... The manuals proved adequate to maintain the vehicles in the past, however there was no apparent resources committed to updating the manuals to reflect engineering changes and modifications. Most are outdated."

The DTC has engaged PB to conduct a Configuration Management Study on all of the Corporation's handling and updating of technical documents, including manuals and associated paperwork. All vehicle manuals are stored in the Electronic-Lab (E-Lab) along with Wayside and Track Manuals. The DTC recently procured a complete set of vehicle drawings that are on a computer in the E-Lab for use by technicians. This computer can be accessed 24-hours a day. An illustrated parts catalog is also included. Recent upgrades to the Vehicle Communication System and the Automatic Train Control System will be documented in electronic and hard copy form. These technical documents will be placed on the E-Lab computer workstation for technician use as well. However, according to a maintenance supervisor, most technicians do not know how to utilize the computer system to obtain maintenance procedures.

When maintenance manuals are either incomplete, not readily accessible, or a computer source of equivalent information is not utilized because technicians are unfamiliar with the system, the process of gathering the technical information needed to perform various tasks is effected. Time spent searching for readily available information adds unnecessary time to the processes.

Effective controls over DPM operations require DTC's management to provide reasonable assurance that objectives regarding DPM systems maintenance are met, and that unintended actions do not occur as a result of outdated or inaccessible information.

Recommendation

We recommend that DTC's management take the necessary steps to ensure the efficient utilization of its maintenance manuals, drawings and catalogs.

We also recommend that the DTC develop a standard operating policy for performing periodic inventory of its maintenance manuals, drawings, and catalogs to ensure that they are complete and updated.

In addition, we recommend the implementation of a log, sign-out sheet, or some other means of enhancing the practice of returning the manuals to a designated location in a timely fashion.

Further, we recommend DTC update all technicians periodically to ensure they are aware of the sources of maintenance documentation and procedural information.

Finally, we recommend the DTC train all users of maintenance material on utilizing the computer system to acquire the information they need.

5. Inadequate Quality Assurance Program

The DTC could not provide documentation of its quality assurance program. The DTC maintenance department is not performing adequate quality assurance inspections. Our audit disclosed that DTC is not using its preventive maintenance software (PMC) capabilities to accurately track performance measures, to provide feedback on operational performance, and to enhance quality assurance inspections. We also determined that the DTC has not implemented training specific to quality assurance.

The performance of comprehensive quality assurance inspections is an industry standard for comparable transit systems including the Toronto Transit Corporation's Scarborough Advanced Light Rail Transit System (Scarborough Line, Toronto, Canada), BC Transit's SkyTrain Advanced Light Rail Transit System (SkyTrain, Vancouver, Canada), and Metro Dade's Metro Mover System (Metro Mover, Miami, Florida). For some systems, comprehensive quality assurance activity is performed monthly, quarterly, and yearly.

The results of quality assurance inspections are intended to provide management with the critical performance measurements it needs to determine whether a process is being performed to a predetermined standard of adequacy and efficiency, and to provide a reasonable level of assurance that any critical deficiency in the system would be detected in a timely fashion. In the absence of adequate quality assurance inspections, management is unaware of whether a process is being performed as intended, or whether a critical problem exists in the system. Thus, a sub-standard maintenance process could continue to be performed indefinitely, or until the system, upon which the sub-standard process was applied, fails.

The DTC indicated that it has implemented a spot check inspection to be performed by a supervisor or manager. Preventive work orders will be randomly selected and checked for completeness and correctness per the manufacturer's procedure. Nevertheless, the DTC has not performed the level of quality assurance inspections that needs to be performed. For example, according to Parsons Brinckerhoff, Inc. (PB), "no proactive measuring of specific dimensions, confirming installation specifications, (torques, forces, etc.) or checking of tolerances is conducted (on the guideway)." DTC's preventive maintenance software (PMC) has the capability to track work order statistics such as manpower utilization and estimated time to complete work orders. However, the system is not being utilized to provide feedback on operational performance as intended, because management does not regard the software as user friendly.

Recommendation

We recommend that the DTC develop and implement a comprehensive quality assurance program adequately designed to provide critical and timely feedback, necessary to improve the quality of maintenance operations.

We also recommend that the DTC adequately train the individuals that are delegated the responsibility for administering the program, using predetermined, and/or industry training standards.

Finally, we recommend that the DTC begin tracking critical maintenance performance measurements, assessing feedback, and implementing enhancements to processes.

6. Obsolete and Deteriorated People Mover System Components

The Detroit People Mover system is in immediate need of a mid-life overhaul of its fleet of twelve vehicles. Except for some recent upgrades, (i.e. Automatic Train Control, truck overhaul) the vehicles are virtually the same as they were when placed into operation in 1987. The vehicles are equipped with first-generation automated rail technology, which has not been adequately upgraded with newer technology. One vehicle has been out of service for at least seven years. The DTC has used this vehicle for replacement parts for the other vehicles in the fleet. All DTC automated rail vehicles are in need of a complete mid-life overhaul.

According to DTC management, limited progress has been made on the recommendation to City administration for a vehicle overhaul. Funding shortages have postponed the implementation of the mid-life vehicle overhaul. The DTC prepared a specification for the project and issued it in the summer of 2003 but the funding failed to materialize. In the fall of 2004, the DTC submitted its proposed capital budget for fiscal 2005-06 through fiscal 2007-08 to the City's administration, in the amount of \$43.9 million. The mid-life overhaul is listed on that proposed budget as a \$12.0 million expenditure. In November 2004, "Proposal T" (a \$32.0 million bond proposal earmarked for DTC and Detroit Department of Transportation) was voted on and approved by the citizens of Detroit. DTC's portion of the \$32.0 million future bond issue is \$15.0 million.

According to industry experts, rail vehicles should be overhauled and upgraded after 15 to 20 years of service to enhance safety and reliability. Without a mid-life overhaul the reliability of People Mover vehicles will deteriorate, and the likelihood of system failure will increase.

Recommendation

We recommend the immediate completion of its mid-life overhaul on all vehicles.

OTHER ISSUES

Noncompliance with Federal Transit Administration's Directive

For two consecutive quarters the DTC has not complied with the Federal Transit Administration's directive to achieve an on-time maintenance performance rate of 80 percent. We examined the preventive maintenance summaries submitted to the FTA for the fourth quarter of calendar year 2003, and the first quarter of calendar year 2004. We determined that the completion rate for scheduled preventive maintenance on facilities was less than 60% in the fourth quarter of 2003, and less than 50% in the first quarter of 2004.

We recommend that the DTC improve the utilization of its technical manpower to the extent that preventive maintenance on-time performance rate is achieved in accordance with the requirements of the Federal Transit Administration.

DETROIT PEOPLE MOVER



April 29, 2005

Joseph L. Harris, Auditor General
Office of the Auditor General
2 Woodward Avenue, Room 208
Detroit, MI 48226

Dear Mr. Harris:

The Detroit Transportation Corporation (DTC) appreciates the opportunity to respond to the Audit of the DTC Maintenance Department dated November 2004, as prepared by the Office of the Auditor General. One significant event has transpired since the auditors were present and the initial draft of this report: DTC hired a mechanical engineer with 15 years of experience with the vehicle manufacturer and many more years experience in the transportation industry. Mr. Deep Satsangi is the DTC's Maintenance Manager and has proven to be a tremendous asset to the DTC and a reliable source of knowledge and information for the maintenance technicians.

The following represents DTC's comments to the recommendations presented in the Audit Report.

Finding No. 1. Excessive number of open work orders for preventive maintenance

DTC's Response:

The DTC is implementing several new strategies to improve upon the reporting and to increase the preventive work order completion rate.

The preventive maintenance schedule was established at the initial opening of the DPM system. Under the direction of the new Maintenance Manager, we have begun re-evaluating the Maintenance Plan for the system, and reviewing the preventive maintenance work orders and their frequency. The tasks of the PM work orders are being evaluated for the functional purpose to extend the life of the asset. Work orders that are being generated at frequent intervals will be adjusted to correctly meet the manufacturer's standards.

Second, DTC is exploring the option of using more efficient technology to assist in the documentation process and the updating of the PM databases. The DTC has previously identified the need to upgrade its maintenance management system to a more fully-integrated, user-friendly software application. Technicians currently use hand-written notes, as originally produced at the inception of the system. This is a time-consuming and inefficient process. Within the next year, it is DTC's desire to procure a new system

that would employ handheld units to give the Maintenance staff the flexibility to update and receive work orders while onsite or in the field. This will eliminate the hand-written work orders. The technology and software has been proven in other maintenance service type industries.

Finding No. 2: The Mechanical and Electrical Technicians complete training courses at an unacceptable level.

DTC Response:

DTC admits that the original training schedule has not been adhered to during the last several years for various reasons. However, in the past 16 months, DPM technical staff has received vendor training on a variety of subsystems and infrastructure recently updated as indicated below. Maintenance staff has also participated in the reconstruction, testing and commissioning of new guideway sections and a station. Furthermore, a concerted effort is being undertaken to improve upon the skill sets of maintenance staff. One Wednesday each month, a block of four hours will be set-aside for training on the technical training courses identified in the maintenance training plan. Additionally, the DTC implemented and/or replaced the various subsystems listed herein that are not a part of the maintenance plan. Each upgrade project includes a training module provided by the vendor and available in electronic format.

- Rail Grinding

The DPM staff worked closely with representative of Advanced Rail Management (ARM) to implement a new running rail profile developed by the National Research Council of Canada specifically for the DPM guideway. During a period of three weeks in August 2002, the DPM staff assisted the ARM staff in the precision grinding process. The end result was a 15db drop in noise levels on the system with a substantial drop in tonal harmonics. This was the first experience undertaken by the DTC to re-profile the running rail, participated in by many of the DTC maintenance staff.

- Wheel Rail Interface

The DPM along with ARM designed a new wheel profile to match the newly ground rail to further drop wheel based vehicle noise another 5-7db. For the last 3 years DPM staff have been a part of the INTERFACE group. This is a group of transit professionals that meet to discuss and resolve Wheel/Rail related noise issues. The topics and items covered in these meetings are brought back and implemented to improve the DPM technical knowledge base.

- Power Rail Heat Tape

Within the last twelve months, the DTC replaced the power rail heat tape. The heat tape is an electric heating element that is located in the power rails preventing the formation of ice on the power rails. Icing can cause vehicle failure or damage to electrical components.

The new heat tape is a proprietary design with updated monitoring capabilities. This was, again, an upgrade to an existing guideway element. DTC ensured training was provided to DPM technicians on the correct techniques to troubleshoot, splice, and repair problems should they occur.

- DPM Truck Overhaul

The DPM technicians worked with OEM representatives from global manufacturer, Bombardier, to complete the overhaul process. DPM mechanical technicians assisted the Bombardier representatives on the installation of the truck units on the DPM vehicles. This included the setup, measurement and checking of rigging points, the correct torque of fasteners and final rigging checks needed for optimum vehicle performance. This was a valuable training and knowledge gathering exercise.

- Automatic Train Control (ATC)

The ATC system is used to provide safe movement of the DPM vehicle along the guideway. The ATC system is made up of the following components:

1. System Management Center (SMC)
2. Software
3. Vehicle Control Center (VCC)
4. Switch Control System (SCS)

The DPM technicians gained valuable knowledge during the installation phase of this project. During the Testing and Commissioning phase the technicians assisted the Alcatel personnel with problem solving tasks and the general operation of the new software and hardware as it was being integrated.

Alcatel provided one forty-hour course sessions to DPM electronic technicians on the trouble shooting and repair of the new ATC system. DTC opted for a second forty-hour course session to ensure the technicians' qualifications to maintain the equipment. The sessions were videotaped for future training purposes.

The DTC has engaged Alcatel to provide training sessions for the DPM technician on a quarterly basis. This added training will help ensure that the technician's skills and knowledge base is maintained at a high level. It is an enhancement to the original maintenance training plan.

- Vehicle Communication System

The VCS system provides a two-way voice and data communications link between the Control center and the vehicle. This communication link is used for PA and vehicle fault reporting functions. This data link is comprised of telephone lines and radio equipment used to transmit the data. The DPM upgraded the vehicle communications system from an analog system to a digital system. The DPM technicians worked with the manufacturer

TrakCom to install and test the new system. The DPM electronic staff received vendor training from TrakCom on the programming, troubleshooting and repair of the new units.

- Supervisory Control and Data Acquisition (SCADA)

The entire SCADA system is in the process of being upgraded by Johnson Controls. These vital systems monitor and control fire alarms, security, propulsion power, drain heaters, faregates, elevators and station digital signage, CCTV, digital data storage and archiving, fiber optics and guideway lighting. The DPM technicians have begun to train on the fiber optics upgrade portion that was upgraded from an OC-3 protocol to an OC-12 protocol. Johnson Controls will provide the training to the electronic technicians on each SCADA sub-system as it is completed, beginning this spring. This training will consist of several Internet-accessed modules and onsite training of a minimum of 40 hours each.

- Vehicle Overhaul

In addition to the listed training items, the DPM staff will train on the new subsystems contained in the vehicle overhaul scheduled for 2006.

Due to the considerable upgrade, replacement, and refurbishment of DTC equipment, properties, and systems, DTC will be updating the maintenance training plan to reflect the equipment manufacturers' recommendations.

Last, to improve upon the technical skills of employees, the DTC increased the level of tuition reimbursement for the completion of classes at technical trade schools, community colleges and at the university level.

Finding No. 3: Mechanical and Electrical technicians do not have adequate access to tools to perform their tasks efficiently.

DTC's Response:

All DTC technicians have tool sets for their respective craft. The DPM currently has two complete sets of tools with boxes in its storeroom. There was, however, a slight delay in processing a purchase request for toolboxes due to confusion on the actual set to be purchased. No other deficiency exists. DTC has recently hired an experienced procurement manager, and no backlog exists for purchase requests.

Finding No. 4: Poor utilization of Maintenance Manuals and Related Software

DTC's Response:

DTC accepts the Auditor General's finding in this regard and is proceeding with implementing the recommendation under the direction of the recently hired Maintenance Manager.

Finding No. 5: Inadequate Quality Assurance ProgramDTC's Response:

DTC recognizes the need to develop a comprehensive quality assurance program. DTC is in the process of securing additional human resources with the technical knowledge, experience and educational background necessary to implement the program in the very near future. DTC is very conscious of the critical nature of the function, and, to a limited degree, has relied on contracted engineers to assist DTC in performing this task during the last several years.

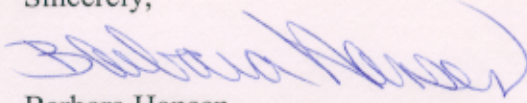
Finding No. 6: Obsolete and Deteriorated People Mover System ComponentsDTC's Response:

DTC has made considerable progress on upgrading major systems as indicated below.

- DTC has been fortunate to secure funding for the mid-life vehicle overhaul project. DTC issued a Request for Proposals for the vehicle overhaul in March 2005. A pre-bid meeting was held on April 21, 2005. It is anticipated that a vendor will be selected by July 2005; the DPM plans to provide the first vehicles for overhaul after the Super Bowl in 2006.
- DTC has replaced the vehicle communications system (VCS). Completed March 2003.
- DTC has upgrade the automatic train control (ATC) system. In service September 2004.
- DTC is replacing the FINs, a part of the propulsion system that rectifies the 600 volts for linear induction use. Expected completion March 2006.
- DTC is replacing the DC/DC converter units. Expected completion December 2005
- DTC is replacing the SCADA (supervisory control and data acquisition) system. Expected completion is fall 2005.
- DTC is upgrading the closed circuit television system. Expected completion fall 2005.
- DTC is installing electronic passenger information signs in the People Mover stations. Expected completion 2005.
- DTC is refurbishing the escalator units in the Bricktown and Financial District stations. Expected completion June 2005.

The courtesy afforded DTC by your auditor's in conducting the audit is appreciated. Should you have any questions on the content of this response, please do not hesitate to contact me.

Sincerely,



Barbara Hansen
Interim General Manager

Attachment: Tentative Maintenance Training Schedule

Copy: Sharon Gipson, Deputy Auditor General

2005 DPM Maintenance Department Training Plan

Project/Event Name: Quarterly Training Schedule

Organizer's Name: DTC Maintenance

The purpose of the following training sessions is to enhance the skill sets and the knowledge base of the Maintenance employees. These training sessions will be conducted in house and by vendors as needed. The dates and course subjects may change slightly to maximize the use of resources available.

Project Phase	Starting	Ending
Sonnet 101 Training	5/3	5/16
JMUX Training	5/9	5/21
Mechanical Technician Overview of OC-12	5/29	5/31
Vehicle Operators Training I	5/16	5/28
Vehicle Operators Training II	6/1	6/11
QRP Refresher Training	6/13	6/17
Vehicle Operators Training III	6/20	6/30
Fare Gate PM refresher course	6/25	6/26
Guideway Switch PM	7/10	7/17
SCADA CK720 Training	7/18	7/22
Alcatel Tech Training (Antenna & Tachometer)	7/24	7/24
Alcatel Tech Training RLB boxes & loop Cable	9/11	9/18
Electrical Equipment Training Oscilloscope	9/24	9/24
Alcatel Station controller trainer	10/22	10/23
QRP Refresher Training	11/7	11/18
Faregate Head Mech Training	12/4	12/11

2005		
January	February	March
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April	May	June
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July	August	September
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October	November	December
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